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ABSTRACT

With focus on improving the effectiveness of the Mathematics Laboratory at Somerset County College, this paper provides background information on individualized instruction programs and learning centers, assesses the current status of the Math Lab, and offers a series of recommendations for immediate implementation. The first sections set forth a series of 12 philosophical assumptions underpinning the learning center concept and identify the goals and objectives of learning centers. The next section argues for a definition of individualized instruction that takes into account appropriate teacher roles and behaviors as well as student activities; and identifies the components of a systems approach to individualized instruction as assessment of learner needs, diagnosis, prescription, interaction process, evaluation, reassessment, follow-up, and recycling. After presenting a hierarchy of learning improvement programs which places remedial courses at Level I, learning assistance for individual students at Level II, course-related learning services at Level III, and comprehensive learning systems at Level IV, a proposal is presented for moving the Somerset Math Lab from Level II to Level III and then Level IV. Following a set of specific recommendations for Math Lab utilization in fall 1984, the paper offers a proposal for the future of the Math Lab and developmental math courses at the college, focusing on instructional materials, management, student motivation, and staffing. (AYC)

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Individualized Instruction Programs and Learning Centers

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A. Philosophical Assumptions Underlining the Learning Center Concept:

1. People learn in different ways and at different rates. Thus it is encumbent upon educators to provide for these differences.
2. Individualization of instruction is a PROCESS, not a program nor a curriculum strategy. The PROCESS is comprised of 6 subsystems:
   a. Assessment of learner needs
   b. Diagnosis of learner needs
   c. Prescription
   d. Interaction Process
   e. Evaluation
   f. Follow-up, recycling, and re-assessment
3. Professional roles in education should conform to the tasks to be performed in implementing a process approach to individual instruction.
4. The Learning Center (or Math Lab when concentrating on Math Skills alone) is the focal point of the educative process when a process approach to individualization of instruction is implemented.
5. At every stage of development the student is capable of participating in goal setting, decision making, and the exercise of options related to their own learning.
6. When offered options and alternatives with respect to what will be learned and how it will be learned, the individual will generally select those objectives and strategies that will best meet his/her needs at the time of choice.
7. Students are capable of self-directing much of their own learning.
8. Education is learning to learn; thus the movement toward independence in learning strategies should be encouraged.
9. Print and non-print media (visual/audio/computer) are essential to the accommodation of learning styles and individualization of instruction.
10. Students' feelings about what they are learning are as important as the skills and knowledge being learned.
11. Students can learn most subject matter course material (especially factual material) directly from educational media, with minimal teacher intervention.
12. Lectures provide enrichment and motivation but actual learning is an individual process.

Thus, Learning Centers represent a high level of sophistication in the integration of human and academic resources. Such a system implies the need for differentiated staffing patterns and such system supports as computers, teachers, instructional aides, and student assistants involved in a team effort to accommodate the uniqueness of each individual learner. Attention to a student's style, rate, and patterns of learning as well as the differences in interests and aptitudes should be addressed.

B. Goals and Objectives of Learning Centers

Goals

1. To develop independent, life long learners
2. To develop self actualizing individuals

Objectives

1. To accommodate diverse learning styles
2. To provide teaching-learning options not available in the self-contained classroom
3. To provide the opportunity for mediated experiences when first hand experiences are not feasible nor as satisfactory as the mediated experience i.e., use of computer graphics in curve drawing/analysis, use of slow motion camera to observe natural phenomena, etc.
4. To provide opportunity for independent, self-directed study
5. To provide the opportunity for students to share in the decision-making involving their own learning
6. To develop process skills and instrumental skills using the media/computers
7. To develop initiative, self-direction, independence, responsibility, decision-making, positive self-concept, confidence and organizing skills in students
8. To develop information retrieval skills using print and non-print media
9. To serve as a catalyst for change and the vehicle for continuous professional staff development
10. To facilitate implementation of a Process Approach to individualization of instruction.

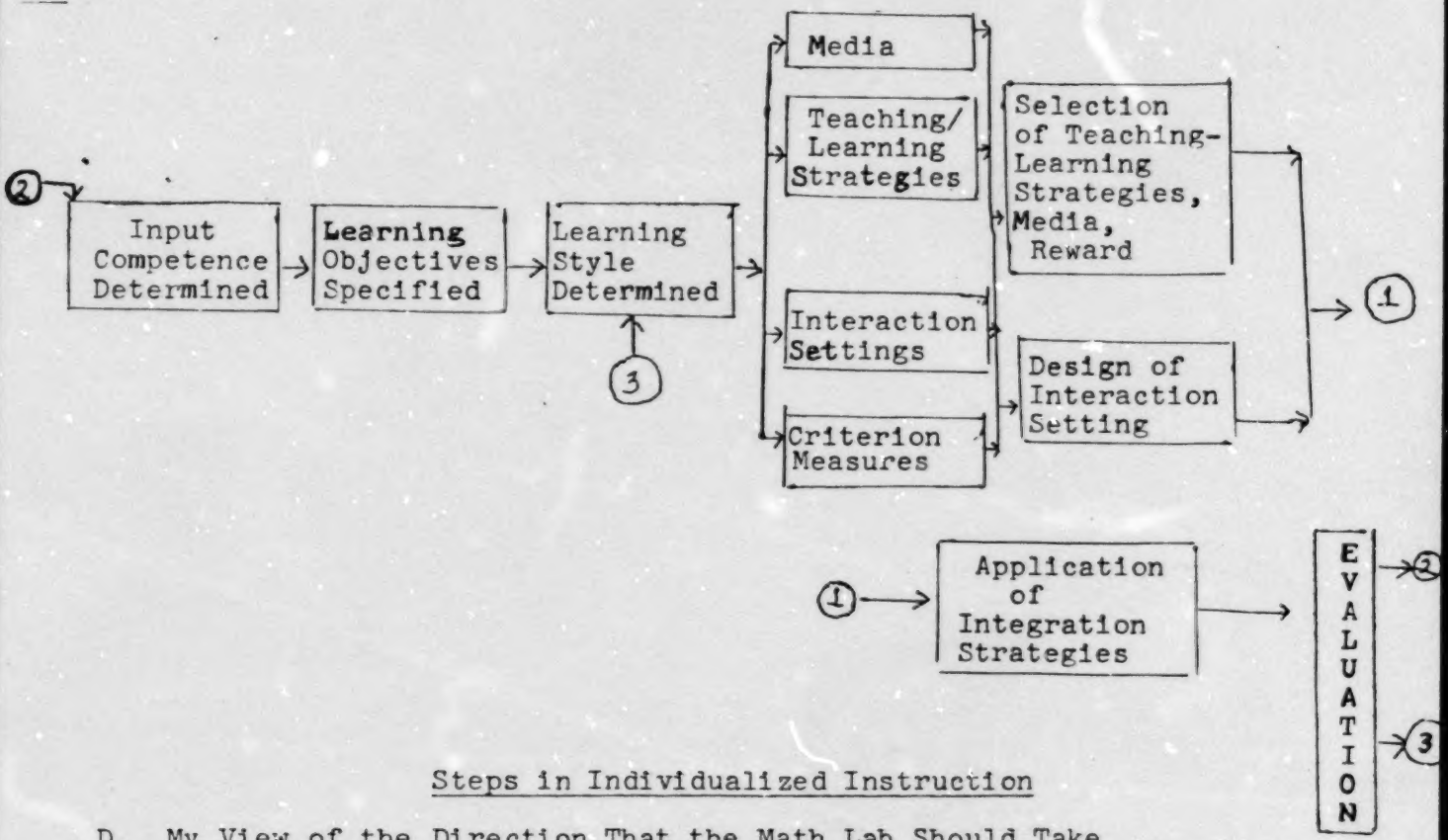
C. The Process Approach: Problems with Definition

1. Most definitions encompass concepts of self-pacing, self-scheduling of work periods, beginning instruction in a given subject at a given point appropriate to the learner's past achievement, etc. But, to be meaningful, the focus should not merely be on pupil activities in an individualized approach but upon teacher behaviors as well. The academic instructor is the content specialist and the manager of the instructional process. He/she interacts with the staff to extend the range of options for learning.

   In the Loop College in Chicago Individual Needs Program, a program identified as highly successful for developing students' achievement, the course instructor is a "focusing agent" for the student and is learner-centered and caring. He/she focuses on learners' needs and responses, manipulates the learning environment to improve learners' achievement of course objectives, and uses developmental program resources to extend the range of options and support available to the students. Thus collaboration among developmental staff is necessary to develop the needed techniques.

   Research has shown that programs with little or no success have made the decision that the Course Instructor's Role is to teach course content and information in traditional, inflexible ways. These programs use professional staff only, ignoring the necessity for collaboration and ignoring staff development needs.

2. Individualized instruction, requiring the systems approach to carry out its 6 interrelated elements (a) assessment of learner needs, b) diagnosis, c) prescription, d) interaction process, e) evaluation, f) reassessment, follow-up, and recycling) necessitates close attention to detail to make sure that all curriculum requirements are being met. Files must be kept on each student in order to properly assess the individual's learning needs and style from data; diagnosis is defined as interpreting this data and **rendering** intuitive judgment based on it; prescription involves **translating** the diagnostic statements into viable teaching-**learning** strategies.

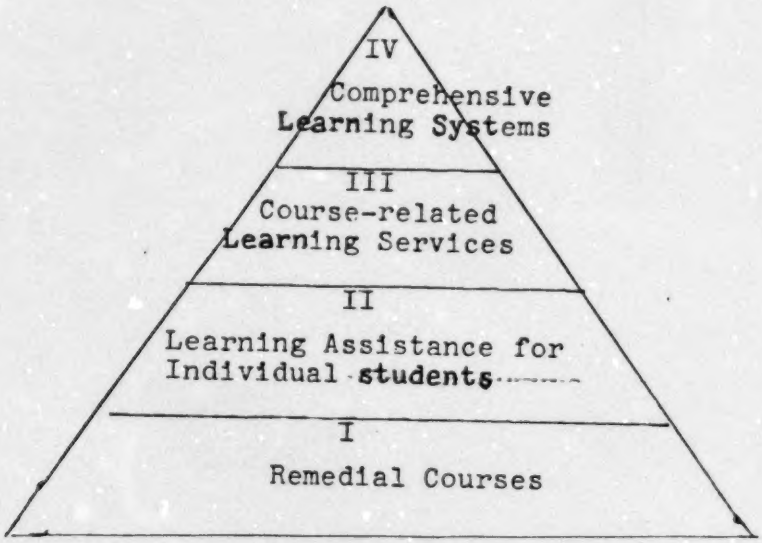


Steps in Individualized Instruction

D. My View of the Direction That the Math Lab Should Take

I agree with the research outlined in Ruth Talbott Kumig Raising Academic Standards: A Guide to Learning Improvement (1983, 21) that The Hierarchy of Learning Improvement Programs is

HIGH POTENTIAL FOR IMPROVED LEARNING AND POTENTIAL CHANGE



LOW POTENTIAL for IMPROVED LEARNING

1. **Present Stage:** Presently, our Math Lab is at Stage II where tutorial assistance for individual student is based on assumptions that:

   a) the student has the problem and therefore must seek the solution.
   b) students can overcome deficiencies through independent study and tutorial assistance.
   c) personal attention helps to counter low self-esteem and poor study habits and will enable student to overcome academic failure.

   Learning assistance for individual students offers many advantages over isolated remedial courses. When established in addition to instruction in basic skills, the likelihood increases that some students' atypical needs will be met and their learning improved.

   I think that this is a first step out of the narrow confines of a separate program toward more comprehensive and better coordinated services; and the academic instructor's first step toward creating a more responsive classroom environment. However, learning assistance to individuals is not effective as a total program in my opinion. Tutorial assistance to individuals, when it is the only service, is the least successful for students' overall success because it fails to address students' very real weaknesses in knowledge and skills. Such informal or "walk-in" learning assistance has **several** major disadvantages:
   a) it is not systematic.
   b) it tends to be used too little, too late.
   c) it happens after a failure has occurred rather than earlier to prevent failure.
   d) it **usually is avoided by** the students **who** need it the most.

Thus, I perceive our Math Lab as being a Tutorial Center at present. However, I think that there is a limited potential for improved learning if not developed to Level III.

2. Level III Programs - next stage of development

As an interim step, I favor systematic coordination of developmental objectives and activities into academic course assignments which distinguishes Level III programs from the lower-level programs. All the students within a given class or course have the opportunity to participate in these supplementary activities.

The assumption in Level III Programs is that the college must provide whatever instruction is necessary to bridge the gap between students' skills and knowledge at entry and those required to master the course material.

Thus, I see the underlying philosophy behind supplementary instructional opportunities as the principle of mastery learning to ensure that appropriate learning occurs. Students' learning needs are presented as being necessary because of the nature of the objectives and content of the course rather than because of students' deficiencies.

Therefore, all students have access to supplementary, possibly innovative, instructional experiences which benefit nonremedial students as well. Adjunct learning experiences for review, reinforcement, and/or reteaching of selected requisite topics are integrated into the ongoing requirements for the course. Through a variety of assignments, including media, tutorial, and small-group learning experiences, students receive additional directed instructional time with important course content. Mastery learning technology, in which students practice and restudy until they demonstrate mastery, is particularly suited to this level of program. I think this is the most effective of the single developmental components for achieving academic success for the underprepared student.

Thus, the feature that distinguishes Level III Learning Centers from Level II Learning Centers is the link of services to specific academic courses. Through this link, faculty receive help both for students with needs that faculty are ill-equipped to handle and with the extremes of diversity that have increased the instructor's workload.

Lower-level components have important roles in Level III programs. Level II "walk-in" learning assistance leads to problem-solving interaction among students, academic faculty, and developmental personnel for learning objectives presently outside the course-related service. The learning assistance center becomes a laboratory for experimenting with more successful instruction

and a proving ground for innovations that can lead to more systematic and effective higher-level services. The Coop Education course will be part of this experiment.

3. Comprehensive Instructional System - Level IV

Comprehensive instructional systems are synthesized out of conventional instructional practices and developmental learning theory, guided by the practical experience of what works the best for given students in a particular course. A comprehensive system includes whatever content, personal growth, and learning activities students need to accomplish the objectives of a course, merged into a coherent and unified instructional program using personalized course and instructional support activities. Comprehensive systems are best evolved out of experiences derived from lower level programs.

Two successful programs, the quasi-modular approach (QMA) at Southern Illinois University used to teach remedial and precalculus math and the Chicago Loop College's holistic system of block courses with a full range of support services for individualizing instruction, including peer tutoring and audio visual instruction, best simulate our experiences in Elementary Algebra and present guides for my recommendations which follow.

E. Specific Recommendations for Math Lab Utilization in Fall, 1984

1. Arithmetic Course could have two branches upon completion of Chapter X in Keedy-Bittinger, Arithmetic.
   a) Liberal Arts/Science students proceed to modules in Elementary Algebra as stated in schedule.
   b) Nursing students proceed to module on Nursing Math in order to pass Nursing Math test.
2. Nursing math module can be offered as a no-credit course as a service to the nursing students.
3. Five hour/week College Algebra could be taught with three lectures and two individualized labs. The labs should contain practice and restudy modules until students demonstrate mastery.
4. Technical Mathematics could be scheduled in Mathematics Laboratory. These students have the ability to succeed when learning is made relevant to their central concerns. They respond to immediate methodologies which develop physical-manual skills as well as intellectual and interpersonal competence. Their different levels of interests and maturity lend themselves to a semi-individualized approach to learning. Also, since computer applications are part of the curriculum, the availability of computers is a necessity. Modules for Mastery in College Algebra and Trigonometry can be useful in this course also.

F. A Proposal for the Future of the Math Lab (and Elementary Algebra, Arithmetic, ?)

In addition to modules developed for supplementary/remedial work

in lecture classes, the mathematics learning center "teaches" courses such as Arithmetic, Elementary Algebra, ?, ?, etc. The courses are taught by the method of "semi-independent study", "the process approach to teaching", "self-paced individualized prescribed instruction", or whatever name you like.

INSTRUCTIONAL MATERIALS

1. All course content is modularized with clearly stated objectives. (The modules can be used for other mathematics courses and/or minicourses when prescribed by other departments).

2. Each objective is described in performance terms.

3. For each object there should be a list of study-aids that will help the student, such as, audio-tapes, visual tapes, CAI, lab material, library references, programmed instructional materials, sample tests, seminars/discussions, tutors to answer questions, etc.

MANAGEMENT

1. Students register for each course either through the lecture or through Math Lab Independent Study. (Many CC offer all courses through Trigonometry via both methods of instruction). A student must take a "Method of Learning" psychological test in order to be placed in the Laboratory or Semi-Independent study classes.

2.There are NO scheduled classes; however a student is required to see his/her instructor at least once a week to report progress, seek help, etc. (Instructors are assigned during hour lab is open.. usually have about 70-80 students to counsel).

3. Large group lectures are held periodically (announced on bulletin board) when student interest dictates. These are optional for passing students but required of the student who has failed to pass the unit Mastery Test.

4.No Mastery Test is given without proof of study with tapes, CAI, etc. for at least 3-5 hours in the Math Lab, LRC, Library, etc. (Of course, the time requirement changes depending on the number of objectives in the Unit Test).

FACTORS THAT KEEP "STUDENTS WORKING WITHOUT CHAOS"

It has been shown that the effective Instructor with a conscientious Lab-Coordinator is able to keep students working and coming to class without being scheduled. Thus, Instructors in the Lab setting usually have Training Sessions to learn techniques.

Some factors that are "on-our-side" in preventing chaos:

1) If a student doesn't "punch-in" or "sign-in" at least three times in the Math Lab, LRC, or Library, or Faculty Office, etc., then he/she is counted absent. Students with excessive absences are Administrately Withdrawn. Part of Math Lab Coordinator's job

is to send out warning letters, keep track of absences, and in general help to establish discipline.

2. The teacher keeps the student working by acting as a programmer who sets work guide-lines, acting as a counselor, manager, and at times chaplain.

   a. Consults with student at least 1x per week to guide study.
   b. Keeps a progress report chart for counseling and evaluating success rate.
   c. Computer can keep track of modules completed and all other files for students.
   d. Student has a work-contract which must be adhered to.

3. No more than one Mastery Test is allowed to be taken during any two-day period. Failure to pass with at least an 80% requires restudy and a retest after an interim of at least two-days.

STAFFING OF LABORATORY (Numbers Approximate)

Instructional Aides provide most individual assistance and do test-grading. The Coop students who have received training would qualify or students from four-year colleges who have completed the Calculus sequence or professional tutors with BA degrees who are willing to work for from 10-20 hours a week so that they don't receive benefits. In addition to grading tests and answering students' questions, instructional aides analyze tests on a bontinuing basis, suggest changes, and update answer keys as needed.

Student assistants are Somerset students who have completed Mathematics through College Algebra. They pass out tests, record grades, type, perform other clerical duties and help tutor students in Arithmetic and Elementary Algebra.

The Laboratory should be open on M- Th from 8AM-9PM; F 8AM-4PM; S 8AM-12 noon. It should have a ratio of 10 students to every one staff member maintained. This would probably work out to require a staffing of :

   a) one teacher
   b) one or two instructional aides (depending on space and number of students enrolled per hour. Ex. ElCeritos in California has three aides because they enroll 80 students per hour)
   c) one student assistant.

The high enrollment due to the many courses and sections taught as semi-independent courses make most Math Labs cost efficient.

A minimum level of staffing is usually needed during the "slow-hour" from 4PM to 5PM. Thus, even El Ceritos needs only two to staff their laboratory. (they find that one instructional aide and one student assistant with the Math Lab Coordinator on call is adequate.)

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